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10. The spermatoblasts, during the entire metamorphosis, remain in organic union with the supporting cell, and, through active and passive changes in the latter, are formed into a bundle of spermatozoa.

11. The extrusion of the spermatozoa from the wall of the tubule follows spontaneous or active severing of their connection with the supporting cell, and by lateral pressure from the growing adjacent elements.

12. The various acts of secretion, in every portion of the tubuli, overlap in an orderly manner, and in such wise that at definite points the successive phenomena coincide in time.

If we assume the period of metamorphosis of a spermatoblast as a measure of time, we have

*a.* The close of each period of metamorphosis of the spermatoblasts marks the beginning of the multiplication of the spermospores.

*b.* The beginning of the period of metamorphosis coincides with the preparatory changes in the spermospores for the production of spermatoblasts.

*c.* The preparation for the production of spermatoblasts always corresponds to two periods of metamorphosis; and there are also always two crops in process of formation.

*d.* With the close of each period of metamorphosis there corresponds a generation of spermatoblasts, so that at the close of the metamorphosis, in the same tubule, the material for the next period lies in readiness.

13. In every portion of a testicular tubule a periodic secretion of spermatozoa and an uninterrupted succession of periods of secretion is possible.

14. The periods of secretion in different tubules do not coincide.

15. By means of a uniform alternation of the periods of secretion in the different portions of the tubuli, the conditions are supplied for a continual secretion of semen by the whole testis of a mammal.

## PSYCHOLOGY.

**Scientific Theism.**<sup>\*</sup>—In this book by Dr. Abbot we have an attempted reconciliation between Science, Philosophy, and Religion, in accordance with the scientific doctrine of evolution. As one of the first, if not the first, rational endeavor in this direction, from the stand-point of Philosophy, the book is a noteworthy one. The subject is treated of under three divisions,—viz., a long historical introduction; a part I., on the "Philosophy of Science;" and a part II., on the "Religion of Science." The position of the author is that of Scientific Realism, or Relationalism, as he terms it, as opposed to Idealism or Phenom-

<sup>\*</sup> "Scientific Theism;" by Francis Ellingwood Abbot, Ph.D. Boston: Little, Brown & Co. 2d edition; 8vo.

enism. This Realism is not that of the Schools, but is intermediate between it and its opposed Idealism. In other words, relations are not regarded in the wholesale manner in which they were treated by the Idealists, who asserted them to be purely subjective, and by the Realists, who declared them to be entirely objective; but they are analyzed scientifically into their essentials, objective realities, and subjective generalizations or ideas. On this eminently sound basis Dr. Abbot harmonizes philosophical and scientific thought. His statement of the leading positions in the controversy is as follows (p. 23):

"1. EXTREME REALISM (*Universalia ante rem*) taught that universals were substances or things, existing independently of and separable from particulars or individuals. This was the essence of Plato's 'Theory of Ideas,' and Plato was the father of extreme Realism as held in the Scholastic Period. Scotus Erigena, who died A.D. 880, was the first to revive this doctrine in the Schools, borrowing from the Pseudo-Dionysius Areopagita.

"2. MODERATE REALISM (*Universalia in re*) also taught that universals were substances, but only as dependent upon and inseparable from individuals, in which each inhered; that is, each universal inhered in each of the particulars ranged under it. This was the theory of Aristotle, who held that the *τὸ δὲ τι*, or individual thing, was the First Essence, while universals were only Second Essences, real in a less complete sense than First Essences. He thus reversed the Platonic doctrine, which attributed the fullest reality to universals only, and merely a 'participative' reality to individuals. Until Scotus Erigena resuscitated the Platonic theory, Aristotle's was the received doctrine in the Schools, and the warfare was simply between those two forms of Realism prior to the advent of Roscellinus.

"3. EXTREME NOMINALISM (*Universalia post rem*) taught that universals had no substantive or objective existence at all, but were merely empty names or words (*nomina, voces, flatus vocis*). Though probably not the absolute originator of this *sententia vocum*, as the doctrine came to be called, Roscellinus, Canon of Compiègne, was the first to give it currency and notoriety, and the Council of Soissons, under the influence of the Realist Anselm, of Canterbury, his chief opponent, forced him, in the year 1092, to recant the tri-theistic interpretation of the Trinity, which he had consistently and courageously avowed. The theory of Extreme Nominalism was thus put under the ecclesiastical ban.

"4. MODERATE NOMINALISM, or CONCEPTUALISM (*Universalia post rem*), taught that universals have no substantive existence at all, but yet are more than mere names signifying nothing; and that they exist really, though only subjectively, as concepts in the mind, of which the names are the vocal symbols. Abailard is claimed by some, but probably incorrectly, as the author of

this modification of the nominalistic view; William of Occam, who died in 1347, seems to have been the chief, if not the earliest, representative of it. The 'Encyclopædia Britannica,' xvi. 284, 8th edition, says, 'The theory termed Conceptualism, or Conceptual Nominalism, was really the one maintained by all succeeding Nominalists, and is the doctrine of ideas generally believed in at the present day.'

"5. Albertus Magnus (died 1280), Thomas Aquinas (died 1274), Duns Scotus (died 1308), and others fused all these views into one, and taught that universals exist in a threefold manner, — *Universalia ante rem*, as thoughts in the mind of God; *Universalia in re*, as the essence (quiddity) of things, according to Aristotle; and *Universalia post rem*, as concepts in the sense of Moderate Nominalism. This is to-day the orthodox philosophy of the Catholic Church, as opposed to the prevailingly exclusive Conceptualism of the Protestant world.

"Thus both Extreme Realism and Moderate Realism maintained the objective reality of genera and species, while both Extreme Nominalism and Moderate Nominalism maintained that genera and species possess no objective reality at all.

"In contrast with all the views above presented, another and sixth view will now be stated, which, taken as a whole, and with reference to the vitally-important consequences it involves, is believed to be both novel and true.

"6. RELATIONALISM, or SCIENTIFIC REALISM (of which *Universalia inter res* may be adopted as an apt formula), teaches that universals, or genera and species, are, *first*, objective relations of resemblance among objectively-existing things; *secondly*, subjective concepts of these relations, determined in the mind by the relations themselves; and, *thirdly*, names representative both of the relations and the concepts, and applicable alike to both. This is the view logically implied in all scientific classifications of natural objects regarded as objects of real scientific knowledge. But, although empirically employed with dazzling success in the investigation of Nature, it does not appear to have been ever theoretically generalized or stated."

In his discussion of Idealism Dr. Abbot shows that no school of this type is or has been consistent excepting that of Hegel, the outcome of which is the well-known "existence and non-existence are identical."

In his section on the "Religion of Science" Dr. Abbot shows that he is on a hot trail; but we think that he does not quite reach his goal. The key to his argument is found in the following passages of the summary of this part of his views (p. 208):

"2. Because (the Universe) is infinitely intelligible, it must be likewise infinitely intelligent.

"3. Because it is at the same time both infinitely intelligible

and infinitely intelligent, it must be an infinite subject, object, or self-conscious intellect."

We do not perceive that the inference expressed in 2 (above) is a necessary one; in fact, it is obtained by a confusion of object with subject; therefore 3 cannot be sustained.

We heartily agree with the following brief survey of scientific philosophy (p. 200): "The dualistic and teleological philosophy of Paley belongs to the past; the mechanical and monistic philosophy of Spencer and Haeckel belongs to the present, but is rapidly moving into the past; the *teleological and monistic* philosophy of the scientific method and the organic theory of evolution belong to the future, and will soon be here." We add to this our own belief that a part of this philosophy is contained in Dr. Abbot's book; that some of the rest of it is also here we will endeavor to show in the next number of the NATURALIST.—*E. D. Cope.*

#### MICROSCOPY.<sup>1</sup>

**The Naples Water-Bath.**—Drs. Mayer,<sup>2</sup> Giesbrecht, and Vosmaer have recently constructed a new water-bath for imbedding in paraffine, which differs in many particulars from the one hitherto employed in the Naples Zoological Station. H. Jung, of Heidelberg, furnishes the whole apparatus, including a small water-bath for imbedding under the simple microscope, at sixty-five marks (sixteen dollars and twenty-five cents). In this price the regulator is reckoned at eight marks and each thermometer at two and a half marks. Orders for the water-bath and its accessories are filled by the Educational Supply Co., 6 Hamilton Place, Boston.

This is the most thoroughly equipped water-bath that has thus far been described, and it is admirably well adapted, in size and shape as well as outfit, to those micro-technical uses for which it was designed.

One of the more important improvements in the outfit is the new Bunsen burner (*r*), which consists of a horizontal tube, to one end of which is attached a short, vertical gas-burner. The burner is fixed in a movable stand 3.5 cm. high. The gas-burner only rises to the height of the stand, so that the bath requires to be raised only 4 cm. The bath is thus placed at a height most convenient for work and most favorable to economy of heat. The flame does not smoke, and does not strike back when reduced to its lowest point. With a maximum flame the bath, which has a capacity of 2.5 litres, is brought to a temperature of 60° C. in thirty to forty-five minutes.

Another important attachment of this water-bath is the thermoregulator. A full explanation of this part is furnished with each

<sup>1</sup> Edited by C. O. WHITMAN, Milwaukee, Wisconsin.

<sup>2</sup> Dr. Paul Mayer, "Aus der Mikrotechnik," *Internationale Monatsschrift f. Anat. u. Phys.*, iv., H. 2, 1887.